US009334683B1

(12) **United States Patent**
Kunz

(10) **Patent No.: US 9,334,683 B1**
(45) **Date of Patent: May 10, 2016**

(54) **SYSTEM AND METHOD FOR PROVIDING A MORE RELIABLE INTERCONNECTION BETWEEN A SPRING AND A BRAKE SHOE IN THE COUNTERBALANCE SYSTEM OF A TILT-IN WINDOW**

(71) Applicant: **John R. Kunz**, Douglassville, PA (US)

(72) Inventor: **John R. Kunz**, Douglassville, PA (US)

(73) Assignee: **John Evans' Sons, Inc.**, Lansdale, PA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **13/655,416**

(22) Filed: **Oct. 18, 2012**

(51) **Int. Cl.**
E05D 15/22 (2006.01)

(52) **U.S. Cl.**
CPC *E05D 15/22* (2013.01)

(58) **Field of Classification Search**
CPC E05D 15/22
USPC 49/176, 181, 445–447, 453; 16/193, 16/197
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,718,194 A * 1/1988 FitzGibbon et al. 49/181
4,914,861 A * 4/1990 May 49/181
5,027,557 A * 7/1991 May 49/181
5,210,976 A * 5/1993 Cripps 49/181
5,232,208 A 8/1993 Braid et al.
5,371,971 A * 12/1994 Prete 49/380
6,041,475 A * 3/2000 Nidelkoff 16/193
6,151,832 A * 11/2000 Opielski et al. 49/181
6,553,620 B2 * 4/2003 Guillemet et al. 16/197
6,983,513 B2 * 1/2006 Pettit 16/197
7,587,787 B2 * 9/2009 Pettit 16/197
7,726,073 B2 * 6/2010 Ifko 49/181
2004/0163209 A1 * 8/2004 Pettit 16/197
2006/0230682 A1 * 10/2006 Ifko 49/181

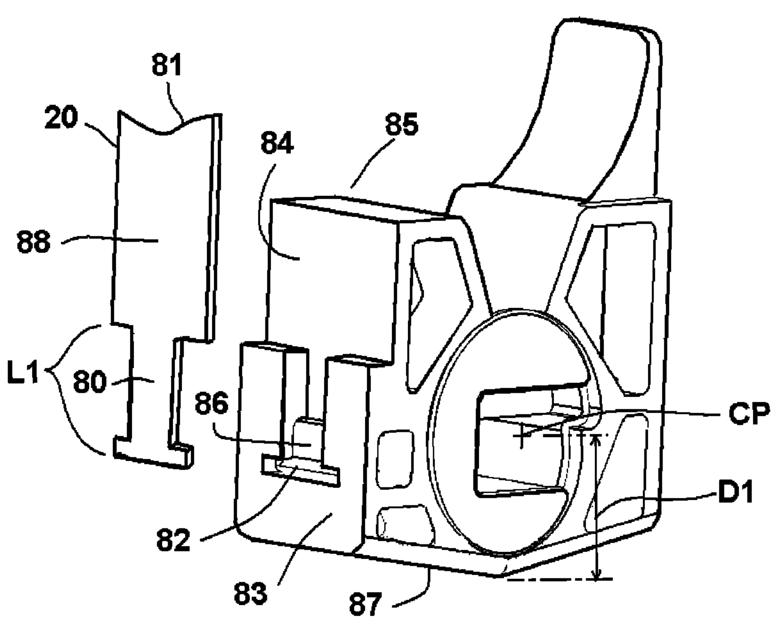
* cited by examiner

Primary Examiner — Katherine Mitchell
Assistant Examiner — Scott Denion
(74) *Attorney, Agent, or Firm* — LaMorte & Associates, P.C.

(57) **ABSTRACT**

An assembly of components that are use in a counterbalance system for a tilt-in window. A coil spring of wound ribbon is provided that has a shaped head. A brake shoe housing is provided that connects to the coil spring in such a manner that fatigue stresses are reduced in the coil spring as the tilt-in window is operated. The brake shoe housing has a receptacle slot formed into one of its side surfaces. An open relief is formed immediately above the receptacle slot. The open relief abuts against and supports the ribbon of the coil spring just behind the shaped head. By engaging the shaped head of the coil spring and supporting the coil spring adjacent to the shaped head, stresses experienced by the shaped head are greatly reduced. The result is a coil spring that has a much longer service life.

11 Claims, 7 Drawing Sheets



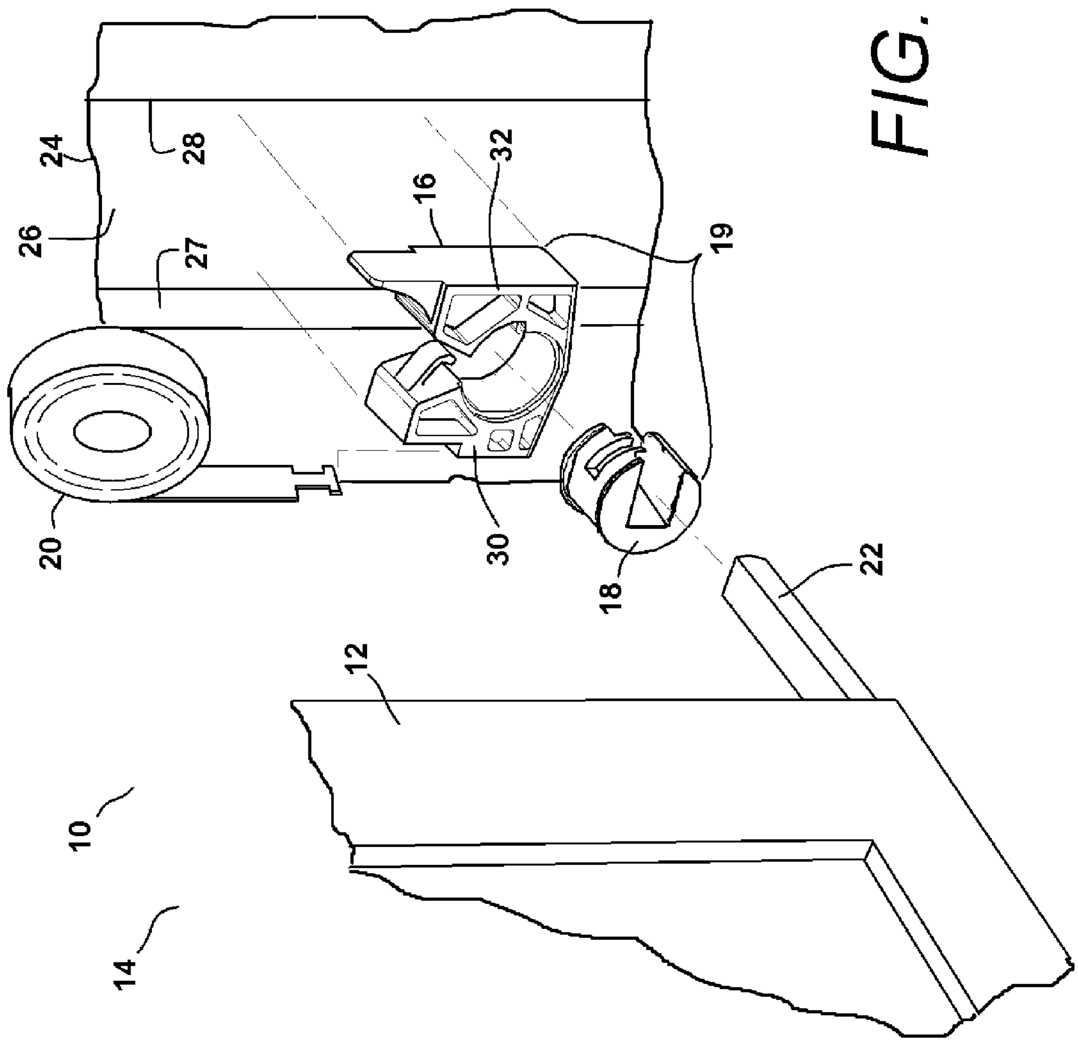


FIG. 1

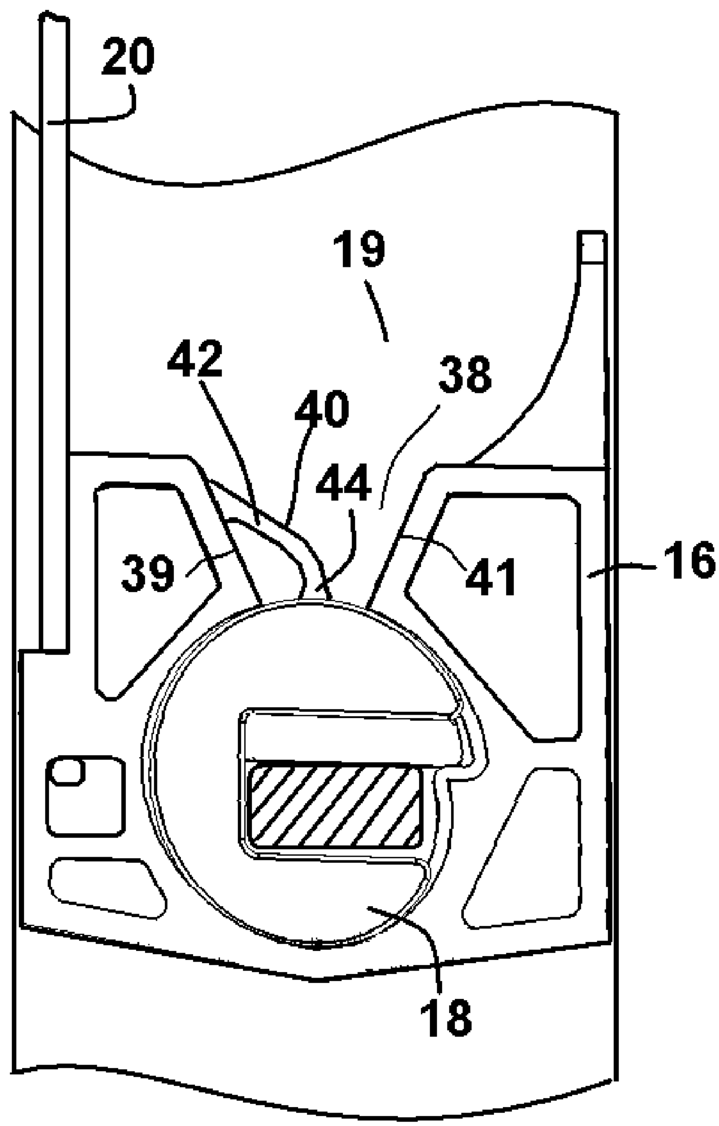


FIG. 2

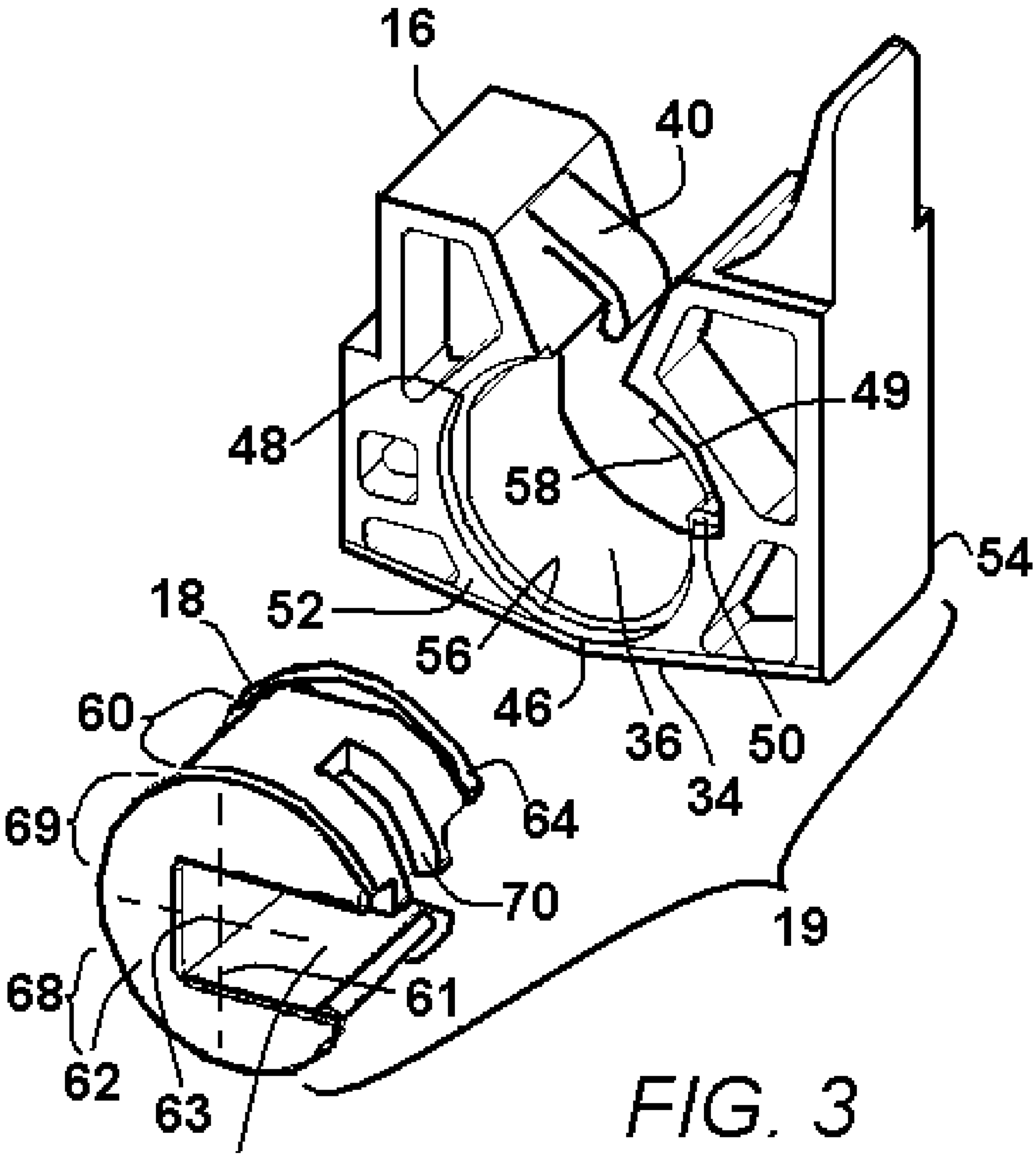


FIG. 3

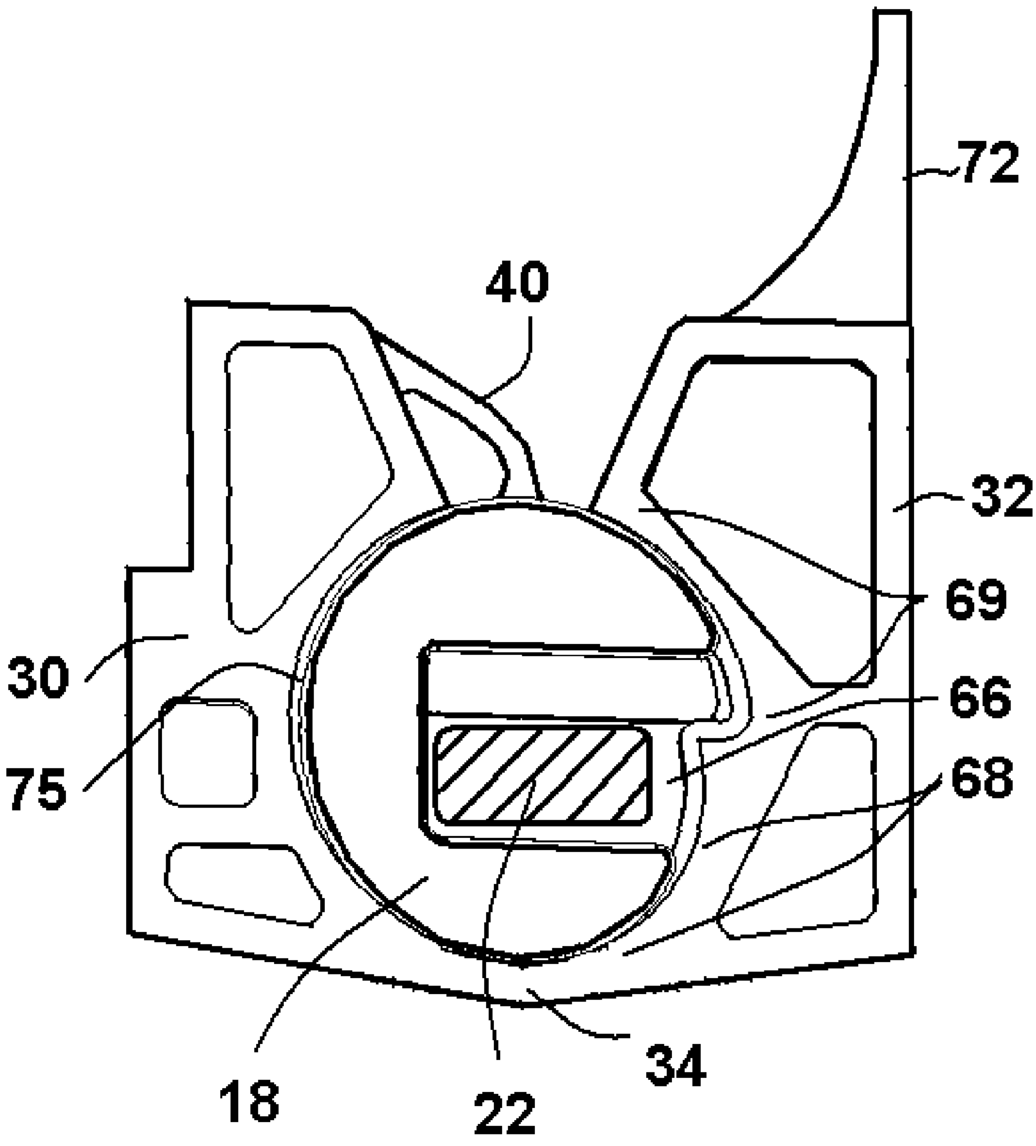


FIG. 4

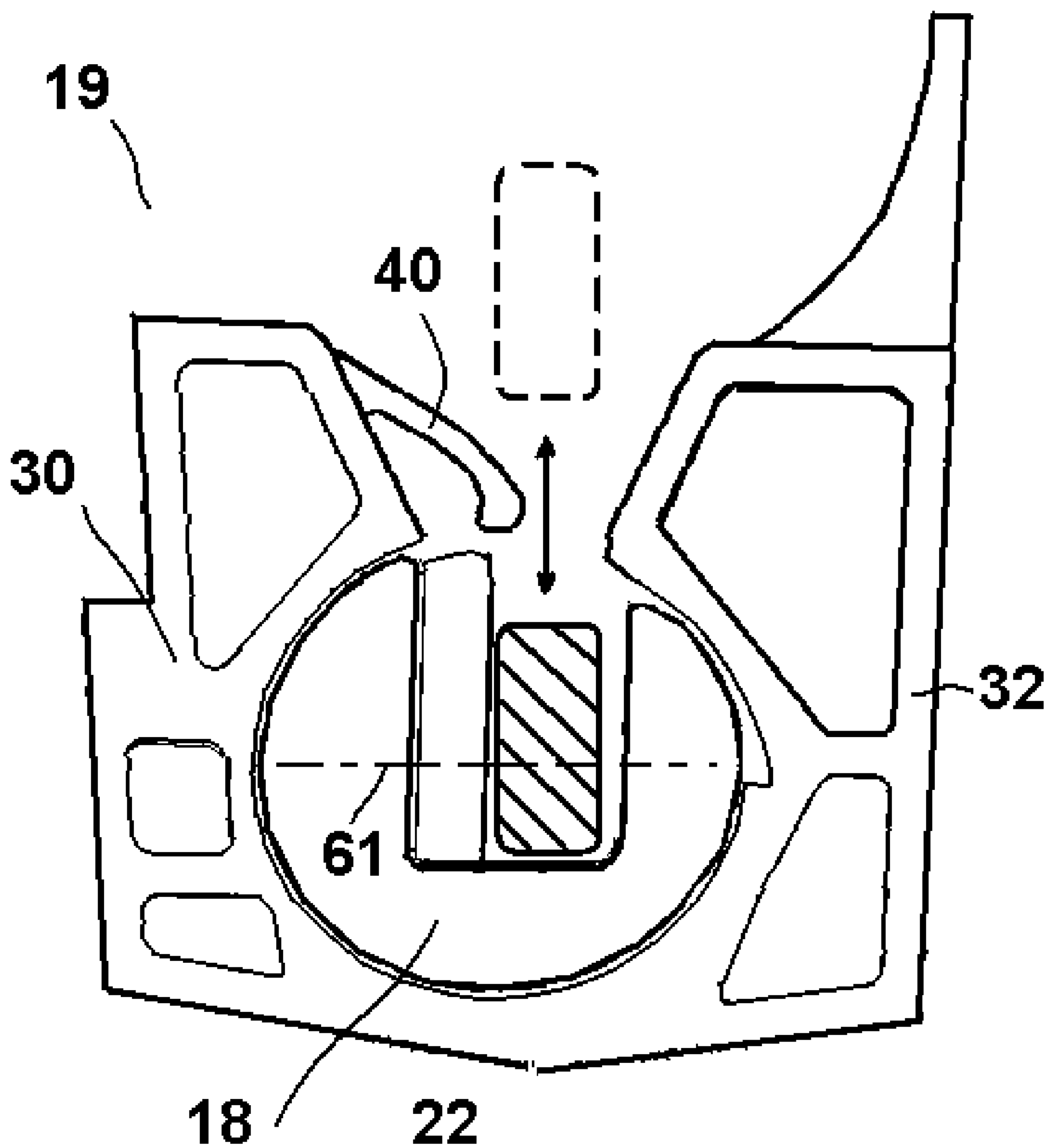


FIG. 5

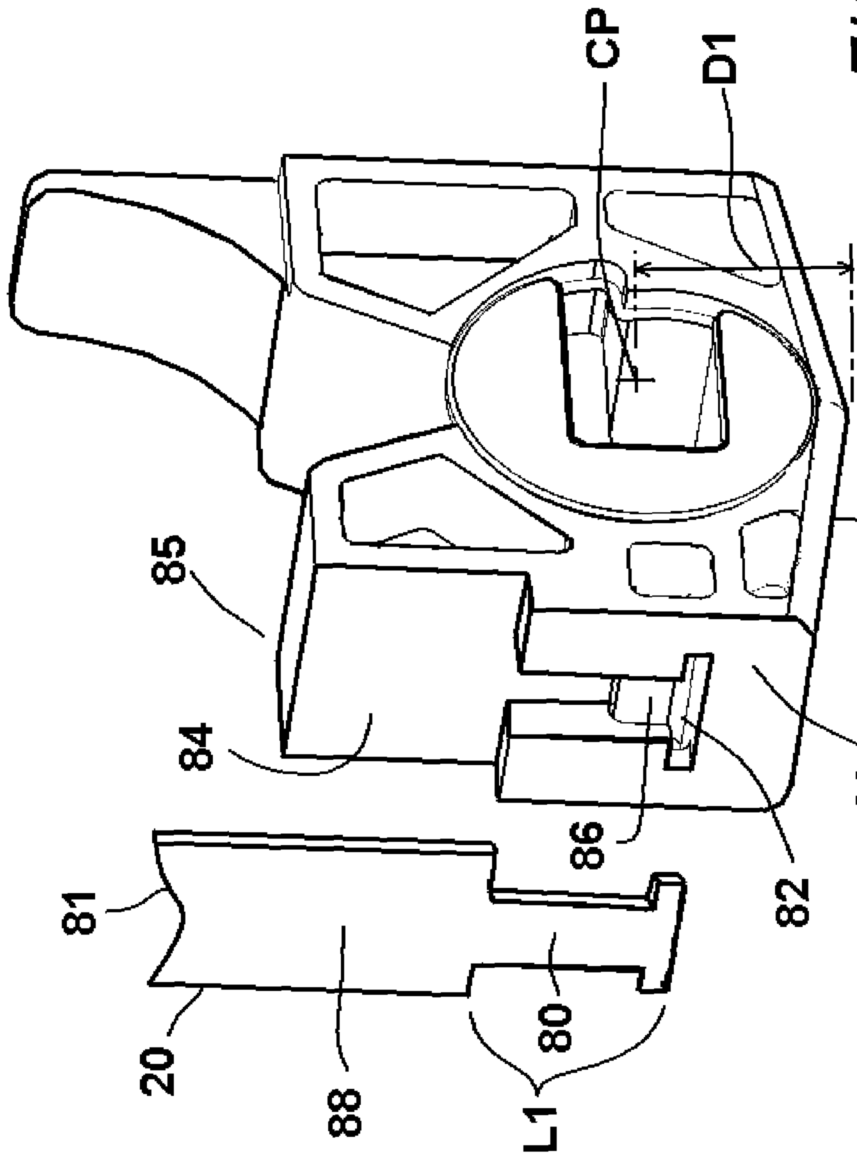


FIG. 6

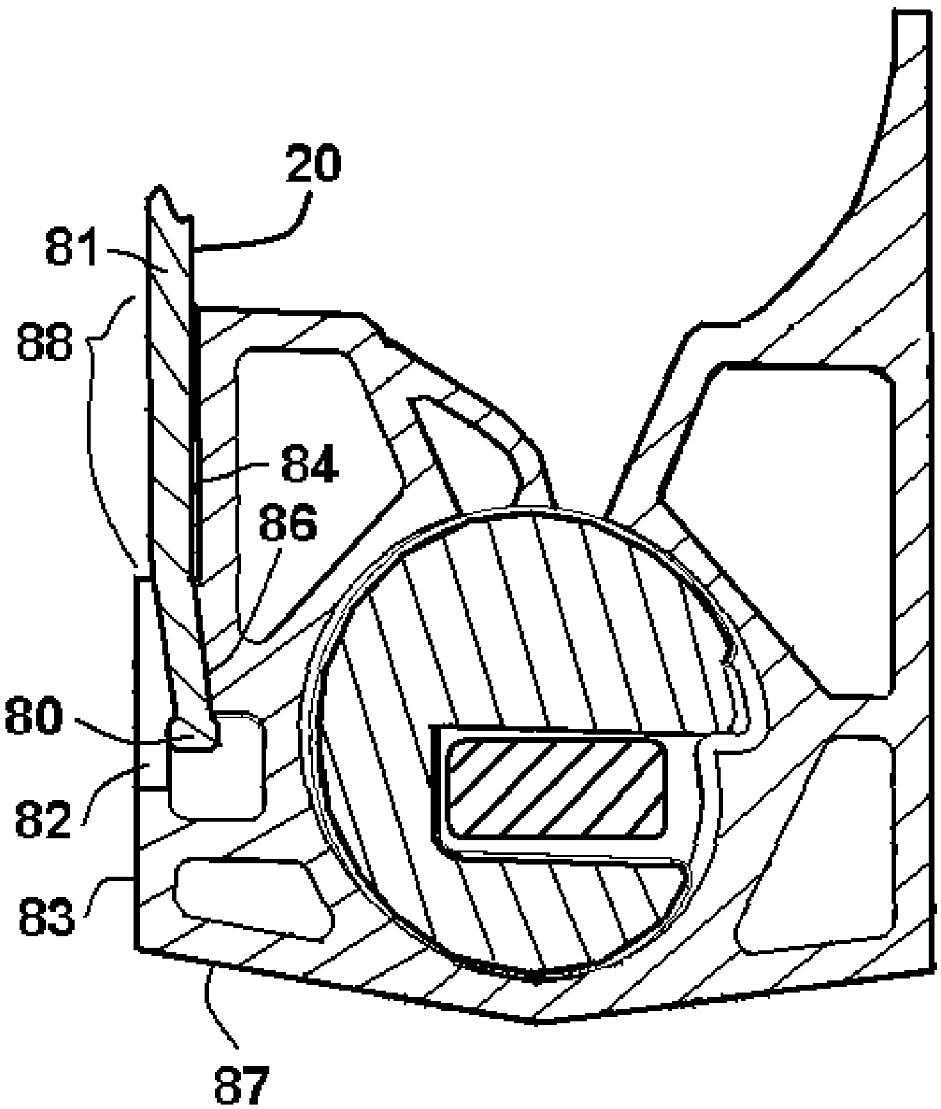


FIG. 7

SYSTEM AND METHOD FOR PROVIDING A MORE RELIABLE INTERCONNECTION BETWEEN A SPRING AND A BRAKE SHOE IN THE COUNTERBALANCE SYSTEM OF A TILT-IN WINDOW

BACKGROUND OF THE INVENTION

1. Field of the Invention

In general, the present invention relates to counterbalance systems for windows that prevent open window sashes from moving under the force of their own weight. More particularly, the present invention system relates to the structure of the brake shoe component of counterbalance systems for tilt-in windows and the manner in which springs connects to the brake shoe.

2. Description of the Prior Art

There are many types and styles of windows. One of the most common types of window is the double-hung window. Double-hung windows are the window of choice for most home construction applications. A double-hung window consists of an upper window sash and a lower window sash. Either the upper window sash or the lower window sash can be selectively opened and closed by a person sliding the sash up and down within the window frame.

A popular variation of the double-hung window is the tilt-in double-hung window. Tilt-in double-hung windows have sashes that can be selectively moved up and down. Additionally, the sashes can be selectively tilted into the home so that the exterior of the sashes can be cleaned from within the home.

The sash of a double-hung window has a weight that depends upon the materials used to make the window sash and the size of the window sash. Since the sashes of a double-hung window are free to move up and down within the frame of a window, some counterbalancing system must be used to prevent the window sashes from constantly moving to the bottom of the window frame under the force of their own weight.

For many years, counterbalance weights were hung next to the window frames in weight wells. The weights were attached to window sashes using a string or chain that passed over a pulley at the top of the window frame. The weights counterbalanced the weight of the window sashes. As such, when the sashes were moved in the window frame, they had a neutral weight and friction would hold them in place.

The use of weight wells, however, prevents insulation from being packed tightly around a window frame. Furthermore, the use of counterbalance weights on chains or strings cannot be adapted well to tilt-in double-hung windows. Accordingly, as tilt-in windows were being developed, alternative counterbalance systems were developed that were contained within the confines of the window frame and did not interfere with the tilt action of the tilt-in windows.

Modern tilt-in double-hung windows are primarily manufactured in one of two ways. There are vinyl frame windows and wooden frame windows. In the window manufacturing industry, different types of counterbalance systems are traditionally used for vinyl frame windows and for wooden frame windows. The present invention is mainly concerned with the structure of vinyl frame windows. As such, the prior art concerning vinyl frame windows is herein addressed.

Vinyl frame, tilt-in, double-hung windows are typically manufactured with guide tracks along the inside of the window frame. Brake shoe assemblies, commonly known as "shoes" in the window industry, are placed in the guide tracks and ride up and down within the guide tracks. Each sash of the window has two tilt pins or tilt posts that extend into the shoes and cause the shoes to ride up and down in the guide tracks as the window sashes are opened or closed.

The shoes contain a brake mechanism that is activated by the tilt post of the window sash when the window sash is tilted inwardly away from the window frame. The shoe therefore locks the tilt post in place and prevents the base of the sash from moving up or down in the window frame once the sash is tilted open. Furthermore, the brake shoes are attached to curl springs inside the guide tracks of the window assembly. Curl springs are constant force coil springs, made from wound length of metal ribbon, that supply the counterbalance force needed to suspend the weight of the window sash.

Small tilt-in windows have small relatively light window sashes. Such small sashes may only require a single coil spring on either side of the window sash to generate the required counterbalance forces. However, due to the space restrictions present in modern tilt-in window assemblies, larger springs cannot be used for heavier window sashes. Rather, multiple smaller coil springs are ganged together to provide the needed counterbalance force. A large tilt-in window sash may have up to eight coil springs to provide the needed counterbalance force. Counterbalance systems that use ganged assemblies of coil springs are exemplified by U.S. Pat. No. 5,232,208 to Braid, entitled Springs For Sash Frame Tensioning Arrangements.

The metal ribbons of coil springs in a window counterbalance system usually experience tension as they support the weight of the window sash. However, this is not always the case. When a window sash is rapidly opened, the upward speed of the window sash may exceed the recoil speed of the counterbalance springs. In such a situation, the metal ribbons of the coil springs may experience a brief period of compression. The ribbons of coil springs are typically uniform in width, except for the free ends of the spring ribbon. The free ends of the spring ribbon are often stamped and shaped so that the end of the spring can engage the structure of the brake shoe. Since the areas near the ends of the spring ribbons are reduced in width, the repeating tension and compression stresses tend to concentrate in these reduced areas. The cycles of tension forces and compressive forces cause the metal ribbon of the coil spring to fatigue. Eventually, the fatigue forces can cause the coil spring to break, thereby disconnecting the coil spring from the brake shoe. This causes the overall counterbalance system to fail.

A need therefore exists in the field of vinyl, tilt-in, double-hung windows, for a counterbalance system with a brake shoe that can attach to a coil spring in such a way that the structure of the brake shoe prevents fatigue stresses from compromising the coil spring. This need is met by the present invention as described and claimed below.

SUMMARY OF THE INVENTION

The present invention is an assembly of components that are use in a counterbalance system for a tilt-in window. A coil spring of wound ribbon is provided that has a free end that terminates with a shaped head. A brake shoe housing is provided that connects to the coil spring in such a manner that fatigue stresses are reduced in the coil spring as the tilt-in window is repeatedly opened and closed.

The brake shoe housing has a receptacle slot formed into one of its side surfaces. The receptacle slot is formed low on the side of the brake shoe housing. An open relief is formed immediately above the receptacle slot. The open relief abuts against and supports the ribbon of the coil spring just behind the shaped head. By engaging the shaped head of the coil spring and supporting the coil spring adjacent to the shaped head, stresses experienced by the shaped head are greatly reduced. The result is a coil spring that has a much longer service life. Furthermore, the connection between the coil spring and the housing also assist in preventing excessive cocking of the brake shoe housing. This prevents wear of the brake shoe housing and increases its operational life.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the present invention, reference is made to the following description of an exemplary embodiment thereof, considered in conjunction with the accompanying drawings, in which:

FIG. **1** is an exploded perspective view of a section of a tilt-in window assembly containing a counterbalance system in accordance with the present invention;

FIG. **2** is a cross section of the embodiment of the counterbalance system shown in FIG. **1**, viewed along line **2-2**;

FIG. **3** is an exploded perspective view of the brake shoe housing and cam element of the counterbalance system;

FIG. **4** is a front view of the brake shoe housing and cam element shown with the cam element holding a tilt post of a vertically oriented window sash;

FIG. **5** is a front view of the brake shoe housing and cam element shown with the cam element holding a tilt post of a tilted window sash;

FIG. **6** is a perspective view of the brake shoe assembly and the free end of the coil spring to show interconnection features; and

FIG. **7** is a cross-sectional view of the subassembly of FIG. **6**.

DETAILED DESCRIPTION OF THE INVENTION

The claimed features of the present invention brake shoe can be incorporated into many window counterbalance designs. However, the embodiment illustrated shows only one exemplary embodiment of the counterbalance system for the purpose of disclosure. The embodiment illustrated is selected in order to set forth one of the best modes contemplated for the invention. The illustrated embodiment, however, is merely exemplary and should not be considered a limitation when interpreting the scope of the appended claims.

Referring to FIG. **1**, in conjunction with FIG. **2**, there is shown an exemplary embodiment of a counterbalance system **10** that is used to counterbalance the sashes **12** contained within a window assembly **14**. The counterbalance system **10** utilizes a brake shoe housing **16**, a cam element **18**, and at least one coil spring **20** on either side of each window sash **12**. The brake shoe housing **16** engages a tilt post **22** that extends from the bottom of the window sash **12**. As the window sash **12** is opened and closed, the brake shoe housing **16** travels up and down in vertical guide tracks **24**. It will be understood that each window sash **12** typically utilizes two counterbalance systems on opposite sides of the sash **12**. However, for the sake of simplicity and clarity, only one counterbalance system **10** is illustrated.

The brake shoe housing **16** receives the cam element **18** to form a brake shoe assembly **19**. The brake shoe assembly **19** rides up and down in its guide track **24**. The brake shoe assembly **19** is biased upwardly within the guide track **24** by at least one coil spring **20**. The guide track **24** has a rear wall **26** and two side walls **27**, **28**. The brake shoe assembly **19** is sized to be just narrow enough to fit between the side walls **27**, **28** of the guide track **24** without causing excessive contact with the guide track **24** as the brake shoe assembly **19** moves up and down with the window sash **12**.

Referring to FIG. **3** in conjunction with FIG. **1** and FIG. **2**, it can be seen that the brake shoe housing **16** is a unistructurally molded unit that requires no assembly. The brake shoe housing **16** is generally U-shaped, having a first arm element **30** and a second arm element **32** that are interconnected by a thin bottom section **34**. In the shown embodiment, the coil spring **20** attaches to the first arm element **30**. In the preferred embodiment, the second arm element **32** has a length that is at least twenty-five percent longer than that of the first arm element.

A generally circular cam opening **36** is formed between the first arm element **30**, the second arm element **32** and the bottom section **34**. Above the cam opening **36**, the first arm element **30** and the second arm element **32** are separated by a gap space **38**. The first arm element **30** has a first sloped surface **39** that faces the gap space **38**. Likewise, the second arm element **32** has a second sloped surface **41** that faces the gap space **38**. Taken together, the first sloped surface **39** and the second sloped surface **41** diverge away from each other as they ascend above the cam opening **36**. The result is that the gap space **38** has tapered sides that lead into the cam opening **36**.

A catch finger **40** protrudes from the first sloped surface **39** of the first arm element **30**. The catch finger **40** extends into the gap space **38** between the first arm element **30** and the second arm element **32**. The catch finger **40** is integrally molded as part of the first arm element **30** and the overall brake shoe housing **16**. The catch finger **40** has a first section **42** that extends away from the first sloped surface **39** at an acute angle. This causes the catch finger **40** to extend in a downward direction. The catch finger **40** then curves into a nearly vertical orientation proximate its free end **44**. The free end **44** is molded to be slightly bulbous in order to prevent the catch finger **40** from hanging up on the tilt post **22**, as will later be explained.

The cam opening **36**, although generally circular, is not round. Rather, the cam opening **36** has a rounded bottom section **46**. On the first arm element **30**, the rounded bottom section **46** transitions into a first curved section **48** that has a larger radius of curvature than the rounded bottom section **46**. On the opposite second arm element **32**, there is a second curved section **49** with the same general radius of curvature as the first curved **48** section. However, the second curved section **49** does not transition directly into the rounded bottom section **46**. Rather, the second curved section **49** is offset from the rounded bottom section **46** with a flat ridge **50**. The flat ridge **50** acts as a stop for the cam element **18**, as will later be explained.

The brake shoe housing **16** has a face surface **52** and a rear surface **54**. The cam opening **36** extends from the face surface **52** back to the rear surface **54**. The dimensions of the cam opening **36** decrease just behind the face surface **52** and the rear surface **54** of the brake shoe housing **16**. The decreases in dimensions create ledges **56** in the cam opening **36** just behind the face surface **52** and the rear surface **54**. The ledges **56** are used to help retain the cam element **18**, which will be later described in more detail.

A key projection **58** protrudes into the cam opening **36** from the second curved section **49**. The key projection **58** is positioned approximately midway between the face surface **52** and the rear surface **54**. Again, the key projection **58** is used to help retain the cam element **18**, which will be later described in more detail.

The cam element **18** is generally cylindrical in shape. The cam element **18**, however, does not have a circular cross-sectional profile. Rather, the cross-sectional profile of the cam element **18** is oblong, being mildly elliptical in its general shape. The cam element **18** has a midsection **60** positioned between a front flange **62** and a back flange **64**. The midsection **60** of the cam element **18** has a long axis **61** and a short axis **63** when viewed in cross-section from either end. The front flange **62** and the back flange **64** are slightly larger than the midsection **60**, therein providing the cam element **18** with a slight spool configuration.

A tilt post receiving slot **66** is formed in the cam element **18**. The receiving slot **66** extends from the front flange **62** to the back flange **64**. However, the receiving slot **66** is not symmetrically positioned. Rather, the receiving slot **66** is eccentrically positioned, so that the receiving slot **66** is closer to one side of the cam element **18** than to the other. For the purposes of this description, the side of the cam element **18** that contains most of the receiving slot **66** shall be referred to as the narrow side **68** of the cam element **18**. Conversely, the side of the cam element **18** that does not retain much of the receiving slot **66** is referred to as the wide side **69** of the cam element **18**.

A groove **70** is formed in the exterior of the midsection **60** of the cam element **18** in the wide side **69** of the cam element **18**. The groove **70** is sized to receive the key projection **58** formed into the cam opening.

Referring to FIG. **4**, in conjunction with FIG. **1** and FIG. **3**, it can be seen that the cam opening **36** receives and retains the cam element **18**. During manufacture in the factory, the cam element **18** is inserted into the cam opening **36** by forcing the cam element **18** into the gap space **38** between the first arm element **30** and the second arm element **32** of the brake shoe housing **16**. When pressed into the gap space **38**, the cam element **18** spreads the first arm element **30** and the second arm element **32** apart. This is achieved by the elastic flexing of the thin bottom section **34** of the brake shoe housing **16**, which acts as a living hinge. The cam element **18** also elastically deforms the catch finger **40** down until the cam element **18** passes. Once the cam element **18** is inside the cam opening **36**, the first arm element **30** and the second arm element **32** rebound to their original positions. Likewise, the catch finger **40** returns to its original orientation. The presence of the catch finger **40** helps hinder the removal of the cam element **18** from the cam opening **36**.

Once the cam element **18** is displaced into the cam opening **36** of the brake shoe housing **16**, the front flange **62** and the back flange **64** of the cam element **18** engage the ledges **56** inside the cam opening **36** and prevent the cam element **18** from exiting the cam opening **36** either through the face surface **52** of the brake shoe housing **16** or the rear surface **54** of the brake shoe housing **16**. Furthermore, the key projection **58** in the cam opening **36** engages the groove **70** of the cam element **18**. This interconnection helps retain the cam element **18** in place, while still enabling the cam element **18** to rotate within the cam opening **36**. The length of the groove **70** and the presence of the flat ridge **50** within the cam opening **36** limit the range of rotation achievable by the cam element **18** in the cam opening **36**. In this manner, the over-rotation of the cam element **18** can be prevented.

The narrow side **68** of the cam element **18** is positioned toward the bottom of the brake shoe housing **16**. This causes the tilt post receiving slot **66** to lie close to the thin bottom section **34** of the brake shoe housing **16**. The tilt post receiving slot **66** receives the tilt post **22**. Consequently, the tilt post **22** of the window sash **12** is held close to the thin bottom section **34** of the brake shoe housing **16**. The result is that the window sash **12** can move to a lower position in the window frame than prior art brake shoe assemblies that support tilt posts in a cam near the center of the brake shoe housing.

Referring to FIG. **5** in conjunction with FIGS. **1-4**, it can be seen that when the window sash **12** is tilted inwardly, the tilt posts **22** of the window sash **12** causes the cam element **18** to turn. Prior, the long axis **61** of the cam element **18** had been vertically oriented. When the window sash **12** is tilted, that orientation changes toward the horizontal. The cam element **18** is oblong in shape since it has a long axis **61** and short axis **63**. Consequently, when the cam element **18** turns, the cam element **18** spreads the first arm element **30** from the second arm element **32** of the brake shoe housing **16**. As the cam element **18** spreads the brake shoe housing **16**, the brake shoe housing **16** flexes in its bottom section **34**. The first arm element **30** and the second arm element **32** engage the side walls **27**, **28** of the track **24**. The result is that the brake shoe assembly **19** becomes locked in position within the guide track **24**.

As the cam element **18** spreads open the brake shoe housing **16**, the gap space **38** between the first arm element **30** and the second arm element **32** increases. The tilt post **22** can therefore be removed from the cam element **18** through the widened gap space **38**. Removal of the cam element **18** in such a manner is hindered by the presence of the catch finger **40**. The catch finger **40** extends into the gap space **38** and provides a physical barrier that prevents the tilt post **22** from exiting the cam element **18**. In this manner, the catch finger **40** prevents a user from inadvertently pulling the tilt post **22** out of the cam element **18** while tilting the window sash **12** inwardly.

It will be understood that if the window sash **12** is broken or otherwise is intended to be removed from the window assembly, such a removal is possible. A person intending to remove the window sash **12** can simply depress the catch finger **40** while pulling up on the window sash **12**. If the catch finger **40** is depressed, it will not block the gap space **38** above the tilt post **22** and the tilt post **22** can be freely removed.

Alternately, since the receiving slot **66** that retains the tilt post **22** is eccentrically positioned toward the narrow side **68** of the cam element **18**, it will be understood that the catch finger **40** will not align directly above the tilt post **22**. Rather, as is shown in FIG. **5**, the enlarged free end **44** of the catch finger **40** aligns above one side of the tilt post **22**. This enables the catch finger **40** to prevent most accidental removals of the tilt post **22**. However, if the window sash **12** is pulled upwardly with a sufficient and determined force, the tilt post **22** will contact the catch finger **40** at an angle. Provided the upward force exceeds a predetermined threshold force of at least five pounds, for example, the catch finger **40** will then elastically yield to the tilt post **22** and the window sash **12** can be removed. Once the window sash **12** is removed, the temporarily displaced catch finger **40** will return to its original position. In this manner, a serviceman or homeowner can intentionally pull the window sash **12** out of the window assembly without any tools or manual brake shoe manipulations. The requirement of sufficient and sustained force required for the removal eliminates most all inadvertent removals of the window sash **12**.

FIGS. **2** and **4** show the brake shoe housing **16**, cam element **18** and tilt post **22** when the window sash **12** is vertical and in its regular operating position. FIG. **5** shows the brake shoe housing **16**, cam element **18** and tilt post **22** when the window sash **12** is tilted and the brake shoe housing **16** is locked in the guide track **24**. The shape of the cam opening **36** varies between the regular operating position of FIG. **4** and the locked position of FIG. **5**. As can be seen from FIG. **4** and FIG. **5**, the shape of the cam element **18** is designed to more precisely fit the cam opening **36** when the cam opening **36** is in its locked position. The result is fewer gaps **75** where no contact exists. In this manner, the cam opening **36** better engages the brake shoe housing **16** and is more resistant to accidental replacement while the window sash **12** is being tilted in. This helps prevent the cam element **18** from being advertently pulled, pushed or otherwise displaced from the brake shoe housing **16**.

In the shown embodiment, the coil spring **20** attaches to the first arm element **30** of the brake shoe housing **16**. This causes the brake shoe housing **16** to have a rotational bias in the clockwise direction as it travels up and down the guide track **24**. To prevent the brake shoe housing **16** from cocking in the guide track **24**, the second arm element **32** is provided with an extension **72**. The extension **72** elongates the second arm element **32** and provides more surface contact with the side walls **27**, **28** of the window guide track **24**. This extended contact prevents the brake shoe assembly **19** from cocking to the bias of the coil spring **20** and binding in the guide track **24**.

Referring to FIG. **6** and FIG. **7**, it can be seen that the coil spring **20** is made of a wound ribbon **81** of steel. The free end of the ribbon **81** is shaped into a T-shaped head **80** that is more narrow than the ribbon **81**. The T-shaped head has a length L**1**. The T-shaped head **80** interconnects with the first arm element **30** of the brake shoe housing **16**. The first arm element **30** of the brake shoe housing **16** is specially designed to receive both the T-shaped head **80** of the coil spring **20** and a length of the ribbon **81** proximate the T-shaped head **80** so as to reduce fatigue stresses in the coil spring **20**.

A receptacle slot **82** is formed in a side wall **83** of the first arm element **30**. The receptacle slot **82** is sized to receive and retain the T-shaped head **80** of the coil spring **20**. A relief area **84** is formed in the side wall **83** of the first arm element **30** just above the receptacle slot **82**. The receptacle slot **82** has a transition section **86** that smoothly leads the receptacle slot **82** into the relief area **84**. When the coil spring **20** is engaged with the brake shoe housing **16**, the T-shaped head **80** of the coil spring **20** enters the receptacle slot **82**, therein mechanically interconnecting the coil spring **20** with the brake shoe housing **16**. Once in this position, a length of the ribbon **81** proximate the T-shaped head **80** lays flush in the relief area **84**. The length of the ribbon **81** supported by the relief area **84** is preferably at least as long as the length L**1** of the T-shaped head **80**. As a consequence, the receptacle slot **82** and the relief area **84** combine to form an anchor structure **85** that engages both the T-shaped head **80** of the coil spring **20** and the length of ribbon **81** behind the T-shaped head **80**.

The T-shaped head **80** of the coil spring **20** is much narrower than the remaining ribbon **81** of the coil spring **20**. As such, as a window sash **12** (FIG. **1**) is opened and closed, changing tension forces and even some compression forces can be experienced by the coil spring **20**. These changing forces create stresses that tend to concentrate in the thin T-shaped head **80** of the coil spring **20**. The stresses fatigue the metal of the coil spring **20** and can eventually cause the T-shaped head **80** to break. By supporting both the T-shaped head and the segment of ribbon **81** behind the T-shaped head **80**, the stress forces are prevented from concentrating in the T-shaped head **80**. The result is that the coil spring **88** does experiences far less fatigue forces and therefore has a much longer operating life.

In order to accommodate both the receptacle slot **82** and the relief area **84**, the receptacle slot **82** must be positioned low on the side wall **83** of the first arm element **30**. The brake shoe housing **16** has a bottom surface **87** at the bottom of the bottom section **34**. The cam opening **36** in the brake shoe housing **16** has a center point CP a predetermined distance D**1** above the bottom surface **87**. The receptacle slot **82** is positioned on the first arm element **30** at a height above the bottom surface **87** that is no higher than that of the center point CP of the cam opening **36**.

Attaching the coil spring **20** to the brake shoe housing **16** at this low point of attachment has secondary advantages. The T-shaped head **80** of the coil spring **20** is generally horizontally aligned with the center of the cam element **18**. Since the brake shoe housing **16** can rotate relative the cam element **18**, this horizontal alignment minimizes the rotational torque experienced by the brake shoe housing **16**. As a result, the cocking forces on the brake shoe housing **16** are minimized.

It will be understood that the embodiment of the present invention counterbalance system that is described and illustrated herein is merely exemplary and a person skilled in the art can make many variations to the embodiment shown without departing from the scope of the present invention. All such variations, modifications, and alternate embodiments are intended to be included within the scope of the present invention as defined by the appended claims.

What is claimed is:

1. An assembly for use in a counterbalance system of a tilt-in window, said assembly comprising:

a coil spring of ribbon having a free end, wherein said ribbon terminates with a shaped head proximate said free end, and wherein said shaped head extends a first length along said ribbon;

a brake shoe housing having a face surface, a rear surface, a bottom surface, a first side surface, and a second side surface, wherein said first side surface and said second side surface extend between said face surface and said rear surface at opposite sides of said brake shoe housing;

a cam opening disposed within said brake shoe housing, and wherein said cam opening has a center point a first distance above said bottom surface of said brake shoe housing;

a receptacle slot formed into said first side surface of said brake shoe housing at a distance from said bottom surface of said brake shoe housing no greater than said first distance, wherein said receptacle slot receives said shaped head of said coil spring; and

a relief formed in said first side surface above said receptacle slot, said relief extending along said first side surface of said brake shoe housing for a second length that is at least as long as said first length, wherein a third length of said ribbon, adjacent said shaped head, extends through said relief and is supported by said first side surface as said shaped head is received within said receptacle slot, wherein said receptacle slot and said relief combine to form an anchor structure for said coil spring that engages both said shaped head and a section of ribbon adjacent the shaped head.

2. The assembly according to claim **1**, wherein said shaped head includes a T-shaped termination.

3. The assembly according to claim **1**, wherein said first side surface of said brake shoe housing is at least twenty-five percent shorter than said second side surface.

4. The assembly according to claim **1**, wherein said brake shoe housing is integrally molded as a single piece of plastic.

5. An assembly for use in a counterbalance system of a tilt-in window, said assembly comprising:

a ribbon formed into a coil spring, said ribbon having a T-shaped termination proximate a free end, wherein said T-shaped termination extends a first length along said ribbon;

a brake shoe housing having a first side surface with a top edge, an opposite second side surface and a bottom surface that extends between said first side surface and said second side surface, wherein said second side surface is at least twenty-five percent longer than said first side surface;

a relief formed in said first side surface that extends partially down said first side surface from said top edge for a second length that is at least as long as said first length, wherein a third length of said ribbon, adjacent said T-shaped termination, extends through said relief and is supported by said first side surface;

a receptacle slot formed into said brake shoe housing below said relief, wherein said receptacle slot receives said T-shaped termination on said ribbon.

6. The assembly according to claim **5**, wherein a cam opening is formed in said brake shoe housing, and wherein said cam opening has a center point a first distance above said bottom surface.

7. The assembly according to claim **6**, wherein said receptacle slot is formed in said brake shoe housing at a position that is no further from said bottom surface than said first distance.

8. The assembly according to claim **5**, wherein said brake shoe housing is integrally molded as a single piece of plastic.

9. An assembly for use in a counterbalance system of a tilt-in window, said assembly comprising:

a coil spring made of wound metal ribbon and terminated with a shaped head, wherein said shaped head extends along said metal ribbon for a first distance;

a brake shoe housing having a first side surface of a first length, an opposite second side surface of a second length, and a bottom surface that extends between said first side surface and said second side surface, wherein said second length of said second side surface is at least twenty-five percent longer than said first length of said first side surface, and wherein said first side surface defines an anchor structure for receiving and retaining all of said shaped head of said coil spring and supporting a portion of said metal ribbon proximate said shaped head, wherein said portion is at least as long as said first distance;

wherein said anchor structure includes a receptacle for receiving and retaining said shaped head of said coil spring;

wherein said anchor structure includes an open relief in said first side surface that supports said portion of said metal ribbon proximate said shaped head.

10. The assembly according to claim **9**, wherein a cam opening is formed in said brake shoe housing, and wherein said cam opening has a center point a predetermined distance above said bottom surface.

11. The assembly according to claim **9**, wherein said receptacle is formed in said brake shoe housing at a position that is said predetermined distance from said bottom surface.

* * * * *